

THE MARKETING AND PROCESSING OF PELAGIC SPECIES ON THE MAIN FISH AUCTIONS OF CENTRAL JAVA

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ABSTRACT

Java Sea fisheries have been developed remarkably for these last twenty years, leading to tremendous increase of the landings. The auctions that drain most of the Java Sea pelagic landings have considerably modified the modalities of fish marketing. They are supposed to improve the flow and the transparency of the commercial transactions as well as the fish evacuation and therefore supply of the markets downstream.

Through the characterisation of the commercial networks, it was tried to find out the constraints to which both the dealers and the transformers are submitted. Focus was put on constraints of profitability or of markets' distance on some processing activities that can lead these operators into a huge concentration and for some of them to a dominating position

The aim was to emphasise the explanatory factors of the price variations on which one could intervene, as well as the price structure with the distribution of the costs and the margins. This work allowed to get the modalities of the supply and demand adjustment and the bias on it, particularly the dominating position of the auction. Hence was estimated the integration of the trade at the first stage of the marketing.

This study has benefited of Nikijuluw's (data of 1990-1992), of Manurung's and Syukur's (1988), and Clucas's (1993) works. The PELFISH Project completed those works on three auctions in Central Java : Tegal, Pekalongan and Juwana. Particularly, it was first made an exhaustive census by monographs on the traders and processors (359 surveys) and secondly a daily tracking of a sample composed of thirty operators during three months (1,747 surveys). The other sources of information came from the harbour's administration (Pekalongan), the auction places (Tegal and Juwana) and the National Bureau of Statistics.

KEYWORDS : Java Sea, marketing, processing, pelagic fish.

ABSTRAK

Perikanan di Laut Jawa berkembang pesat pada dua puluh tahun terakhir, membawa peningkatan yang besar dari ikan yang didaratkan. TPI yang menampung sebagian besar ikan yang didaratkan telah mempengaruhi perubahan model pemasaran ikan. Sebagai titik awal dari pemasaran, mereka diharapkan memperbaiki alur dan transparansi transaksi perdagangan seperti halnya pengangkutan ikan untuk memenuhi pasar pada sektor hilir.

Melalui identifikasi dan karakterisasi pelaksanaan pelelangan dan jaringan perdagangan, dicoba mencari hambatan dimana agen dan pengolah dipertemukan. Penekanan terutama pada hambatan rentabilitas atau hambatan geografis (jarak pasar) pada beberapa kegiatan transformasi yang dapat mempengaruhi pelaksana pada konsentrasi yang tinggi di mana beberapa diantaranya menduduki posisi penting.

Melalui analisis pembentukan harga, tujuan kita adalah menekankan pada satu sisi yang menerangkan variasi harga yang dapat berpengaruh, sedangkan di sisi lain menekankan struktur harga yang teridentifikasi dan "repertision" biaya dan margin. Pekerjaan ini menghasilkan penyesuaian model penawaran dan permintaan serta penyimpangannya, khususnya kuatnya kedudukan pelelangan. Hal ini menghasilkan pula dugaan integrasi perdagangan pada tahap awal pemasaran.

Studi ini sebagai hasil dari pekerjaan Nikijuluw (1994), Manurung dan Syukur (1989), dan Clucas (1993). Proyek PELFISH bermaksud melengkapi dan memperbaharui pekerjaan tersebut pada tiga TPI di Jawa Tengah yaitu kotamadya Tegal, Pekalongan dan Juwana. Khususnya, pekerjaan di lapangan dimulai dengan "exhaustive census" disertai oleh monografik pedagang dan pengolah (359 survey), dan kedua dengan pelacakan sampel komposisi harian dari 30 pelaksana selama 3 bulan (tersedia 1,747 survey). Sumber informasi lain datang dari PPN Pekalongan, TPI Tegal dan Juwana serta Biro Pusat Statistik.

KATA KUNCI : Laut Jawa, pemasaran, pengolahan, perikanan pelagis.

The last twenty years have seen the impressive development of the fisheries of the Java Sea. Considering the main fish auction places on the northern coast of Central Java, landings jumped from 100,000 to 176,000 tons over ten years. This development ties in with the appropriation of the fishing grounds and a policy of building harbour facilities and auction places.

It thrived with such a background of steady growth that prompted accelerated urbanisation, improvements in standards of living and, hence, changing patterns of food consumption, for example an increased demand for animal proteins. By looking at the consumer price index alongside that of fish prices, it can be seen the demand-driven pressure reflected in a relatively greater increase of prices of meat and fish compared to other goods.

This work brought out the constraints of the traders and processors in terms of profitability (economies of scale) or location (distance from consumer markets). Such constraints may result in the marked concentration among operators and the emergence of market leaders.

In analysing price formation, we wanted to highlight first the price variation factors and the price structure with the identification of costs and margins. This work allowed us to understand the intricacies of supply and demand adjustment and the forces influencing that adjustment, one particular example being the prevailing position of fish auctions. It also enabled us to form an opinion of the market's integration at the first stage of the marketing chain.

The study benefited from the works of Nikujuluw (1994), Manurung and Syukur (1989), not forgetting Clucas' survey (1993). Although another methodology was used, the PELFISH project gave us the means to round off and update the marketing situation for the three main auctions : Tegal *kotamadya*, Pekalongan and Juwana. A census of the traders was carried out, plus interviews of 359 operators. A three-month daily survey using as a sample thirty traders and processors¹ (1,747 questionnaires) was then carried out.

Other data came from the harbour's administration (Pekalongan), the auction places (Tegal and Juwana) and the National Bureau of Statistics (*BPS*).

The study used a methodology perfected by ORSTOM (Weigel, 1989).

MATERIALS AND METHOD

The wide-ranging diversity of fish packaging and processing means it needs to choose a criterion to identify the fish auction operators. Clear divisions of labour made them easier to categorise. A product type was chosen (fresh fish, salted, chilled, boiled or smoked fish) as our classification criterion. Some traders sell fresh or salted on board fish as it is, even if it undergoes some form of processing further down the chain. Meanwhile, others do package or process fish bought at auction (chilling, salting and drying, boiling or smoking).

To classify the operators, figures per specialisation at the three main fish auctions (Tegal *kotamadya*, Pekalongan and Juwana) were established, thanks to the general survey. To add to that, the findings of our three-month daily survey told the quantities bought by each type of trader. As a result, it was managed to build up a picture of how the quantities of landed fish are used and distributed through the various marketing channels. Finally, this classification turned to sketching the profile of the fish auction operators.

¹ Taken randomly among buyers on auction places.

RESULTS

1. Characteristic features of the traders

Classification of fish auction traders

Census took in all the three main fish auction operators, including processing traders² (Tab. 1). Most of them were highly specialised, since only 12% claimed to work as both traders and processors.

Furthermore there were seasonal influences on trading operations. Although very apparent, it is far less so when the number of fish auction operators only fluctuates slightly between high and low season. It confirms the professionalism of the traders and processors.

The third observation refers to the relative specialisation of each fish auction as shown by the quantities bought daily by each type of trader. Regarding salted fish, the traders processing the largest amounts are the ones from Tegal *kotamadya* (almost two and a half tons a day during high season). For boiled fish, the biggest processors are the ones from Juwana (more than three and a half tons a day during high season). Meanwhile, the global quantities auctioned at Pekalongan are four times higher than at Tegal *kotamadya* and just under twice as much as at Juwana. The largest amounts there were bought by the traders of chilled fish (more than three tons per day) and salted fish (more than two tons per day). The breakdown of traders per auction place confirms the superior position of Pekalongan. More than half of the total operators work there during the high season (a third in Juwana and just a tenth in Tegal *kotamadya*).

Table 1 : Number of traders and fish quantity bought per day and trader, by type of trader, season and auction place (sample of 359 traders)

Jumlah pedagang dan kuantitas ikan yang dibeli per hari dan per pedagang, menurut tipe pedagang, musim dan tempat pelelangan (jumlah sampel : 359 pedagang)

	High season			Low season		
	Tegal	Pekalongan	Juwana	Tegal	Pekalongan	Juwana
Fresh fish						
Number of traders	22	58	38	20	55	35
Quantity per day and per trader (kg)	934	568	807	453	245	350
Salted fish						
Number of traders	18	36	33	15	33	29
Quantity per day and per trader (kg)	2,460	2,130	1,950	640	1020	570
Chilled fish						
Number of traders	6	31	28	4	29	24
Quantity per day and per trader (kg)	1,333	2,913	1,187	383	824	400
Boiled fish						
Number of traders	1	26	23	1	25	20
Quantity per day and per trader (kg)	1,167	2,387	3,517	500	1,045	1,070
Smoked fish						
Number of traders	1	35	3	1	34	2
Quantity per day and per trader (kg)	200	102	263	80	220	100

Source : field survey (December 1994-February 1995)

² 75%, 65% and 85% of the landings were registered (by TPI and PPN) for Juwana, Pekalongan and Tegal *kotamadya* respectively. Why not the full 100%? Possibly due to errors relating to the quantities at auction or the omission of a few traders. We therefore had to readjustments using TPI or PPN figures.

The specialisation of the auction places relates to the final uses of the fish : preponderance of salted fish at Tegal, chilled fish at Pekalongan and boiled fish at Juwana.

According to the quantities of fish traded, emerges a distribution of an opposite order, depending on the type considered : fresh or chilled fish on the one hand, processed fish on the other (Tab. 2).

Table 2 : Number of traders by daily quantity bought and by type of fish (high season 1994-1995; 359 traders)
Jumlah pedagang menurut jumlah dan jenis ikan yang dibeli per hari (musim ikan 1994-1995; 359 pedagang)

	Chilled	Salted	Boiled	Smoked
0-200 kg	42	16	13	29
200-500 kg	11	18	4	3
500-1000 kg	6	13	8	7
1000-2000 kg	0	20	6	0
>2000 kg	6	20	19	0
Total	65	87	50	39

Source : field survey (December 1994-February 1995)

Seventy five percents of chilled fish traders and 60% of fresh fish traders handled less than 500 kg per day. So fresh and chilled fish are generally dealt with small scale operators; a fact that contributes to providing steadily supply and demand. Conversely, processed fish, apart from the fringe case of smoked fish, is the domain of large scale operators, which could lead to oligopolistic behaviour in the long run.

The Gini curves show strong indices for dried-salted and boiled fish, despite an appreciable difference between the two forms of processing: 10% of the largest processing traders of dried-salted fish market 45% of the annual quantities, against 30% of annual quantities in the case of boiled fish.

The number of suppliers and customers in an indicator of market structure (Tab. 3)

Table 3 : Number of suppliers and customers per trader during the high season with the daily quantity bought and by type of trader (Tegal, Pekalongan and Juwana, 153 traders)
Jumlah pemasok dan pelanggan per pedagang selama puncak musim dalam kaitannya dengan jumlah yang dibeli dan dengan jenis pedagang (Tegal, Pekalongan dan Juwana, 153 pedagang)

	0-200 kg		200-1000kg		1000-2000 kg		>2000 kg	
	Nb of suppliers	Nb of customers	Nb of suppliers	Nb of customers	Nb of suppliers	Nb of customers	Nb of suppliers	Nb of customers
Fresh	1,1	1,3	2,4	6,3	3,1	7,6	3,2	5,4
Chilled	3,5	4,0	3,0	10,0	0,0	n. a.	2,0	7,0
Salted	n.a.	n.a.	6,4	3,4	8,5	3,7	15,4	4,2
Boiled	2,3	3,7	4,7	4,6	12,0	12,0	13,3	6,4
Smoked	n.a.	n.a.	1,7	4,0	n.a.	n.a.	n.a.	4,0

Source : field survey (December 1994-February 1995)

The greater is the increase in quantities traded, the greater the rise in the number of suppliers from several vessels. As for the number of customers, any growth that may occur does so in proportions that depend on whether the fish has been processed or not. With processed fish, the greater the increase in quantity, the more the ratio between number of customers and number of suppliers will diminish. This phenomenon could be analysed as showing greater mutual dependence between the large scale operators and their customers. Large scale operators are subjected to a captive market where they are dependent on the wholesalers commanding export flows out of the provinces, yet nonetheless occupying a dominant position over the whole chain. The market constraints relating to dried-salted or boiled fish are that

explain this fact : little segmented, long distance marketing channels. This phenomenon confirms the difference in market structuring for fresh or chilled fish on the one hand and, processed fish on the other.

Profile of traders and processors

Marketing and processing are dominated by the men, with only one third of operators being women. Nevertheless, the women represent almost half of the operators in fresh fish marketing. Their role decreases when the processing is linked to an increase in the quantities traded (Tab. 4 and 5).

Table 4 : Percentage of traders by gender and type of trader (359 traders)
Persentase pedagang menurut jenis kelamin dan jenis pedagang (359 pedagang)

	Men (%)	Women (%)
Fresh	50	50
Chilled	70	30
Salted	74	26
Boiled	79	21
Smoked	72	28

Source : field survey (December 1994-February 1995)

Table 5 : Percentage of traders by gender and quantity bought per day (359 traders)
Persentase pedagang menurut jenis kelamin dan jumlah yang dibeli per hari (359 pedagang)

	0-500 kg	500-2000 kg	>2000 kg	Total
Men	53	73	86	64
Women	47	27	14	36

Source : field survey (December 1994-February 1995)

Education levels clearly mark the differences according to the gender and professionalism of the operators. One third of them has completed secondary school or university, while 70% and 60% of fresh and chilled fish traders (with the highest proportion of women) have not gone beyond primary school (Tab. 6 and 7). Knowing the relationship between specialisation and quantities traded, it appears that the greater the quantities are handled, the higher is the level of education.

In view of the fathers' employment, it seems that a fifth of traders and the processors have benefited from a family training, rising to a third if we consider the largest of them. Three criteria add weight to this impression of professionalism : length of professional service (12 years on average), average age (43 years), low rates of multiactivity that only applies for 12% of the operators.

Table 6 : Level of education (%) by type of trader (359 traders)
Tingkat pendidikan (%) menurut jenis pedagang (359 pedagang)

	Fresh	Salted	Chilled	Boiled	Smoked	Total
No school	7	1	0	0	11	4
Lower primary	32	19	26	17	36	28
Upper primary	42	28	32	46	44	40
Lower secondary	13	39	37	17	8	19
Upper secondary	5	13	5	17	0	8
University	1	0	0	2	0	1

Source : field survey (December 1994-February 1995)

Table 7 : Level of education (%) and quantity of fish bought per day (359 traders)
Tingkat pendidikan (%) dan kuantitas ikan yang dibeli per hari (359 pedagang)

	0-500 kg	500-2000 kg	>2000 kg	Total
No schooling	8	0	0	4
Lower primary	37	24	7	28
Upper primary	31	55	41	40
Lower secondary	19	13	30	19
Upper secondary	5	6	20	8
University	0	1	2	1

Source : field survey (December 1994-February 1995)

2. Price formation on the fish auctions

Price formation combines factors explaining price variations on the fish auctions with the analysis of price structure.

In the first case, price variations can be explained through a whole set of factors, both quantitative (fish supply, substitutability) and qualitative (the product's physical characteristics, seasonal variations, trader and processor profiles). Given the influence of the products' physical characteristics, our daily survey had to account for size and level of freshness. To study the influence of supply, we first observed the effects of monthly price variations that had taken place over a number of years previously.

The second step was to examine the relationship between price and quantities landed, focusing on the main species, to a daily or monthly time scale. To determine the substitutability, we calculated the daily price elasticity of two species. In all likelihood, the profile of the trader or processor has an influence over the price level, and this should be taken into account in future model-building.

The price structure combines marketing costs and commercial margins that are added to the landing price. Thanks to our two surveys, the first involving all the fish auction traders as a whole and the second, a sample of traders surveyed daily, we were able to quantify the costs and margins.

The interviews of traders and processors (359), the daily surveys (1,747) and data from the harbour's administration of Pekalongan and from the auction places represent our main sources.

Explanatory variables of the price level

- Physical characteristics (species, state of freshness, size)

The highest prices of fresh pelagic fishes are *Euthynnus affinis* (*tongkol*), while *Sardinella gibbosa* (*juwi* or *tanjan*), *Amblygaster sirm* and *Decapterus spp.* (*layang*) are the lowest. As for the salted fish, *Euthynnus affinis* and *Rastrelliger kanagurta* fetch the best prices. However, the selection reveals significant differences according to the auctions. Regarding the fresh fish, Tegal *kotamadya* offers the most attractive prices due to its relative proximity of Jakarta. The average price per kilo was Rp. 1,070 in Tegal against Rp. 740 in Pekalongan and Juwana. As for fish salted aboard the vessels, the three auctions offer similar prices, although Pekalongan is the place where this kind of fish is valued higher (Rp. 550 per kilo against Rp. 430 in Juwana and Tegal *kotamadya*). The privileged situation of Pekalongan could be explained by its better drying-salting facilities.

Our first grading of freshness took in the methods of stocking the fish aboard the fishing vessels (either salted or not). On a large vessel, the first catches are salted. This criterion produces the first difference in prices : the price of fish salted on board is almost 60% lower than that of fresh fish.

A second grading of the level of freshness turned on the quality of fish. As far as fresh fish is concerned, the price per kilo is almost four times higher for superior than for inferior quality. The ratio for fish salted on board is over three.

The observations on price differences according to the stocking method (salted or not) and the fish qualities bring out how much could be improved (Tab. 8).

**Table 8 : Average prices of fish by auction place and by quality
(December 1994-February 1995 : 1,747 transactions) (rupiahs/kg)
Rata-rata harga/kg menurut tempat pelelangan dan kualitas ikan
(Desember 1994-Februari 1995 : 1,747 transaksi) (Rupiah/kg)**

	High	Medium	Poor
Tegal			
Fresh fish	1,250	750	220
Salted fish	600	450	160
Pekalongan			
Fresh fish	1,050	690	350
Salted fish	660	570	270
Juwana			
Fresh fish	740	490	300
Salted fish	470	400	150

Another physical characteristic likely to affect the price is the size of the fish. As far as pelagics are concerned, the differences in size among the smaller fishes are so minimal (Sadhotomo *et al.*, 1995) that this criterion has little influence over the prices. The findings of a survey conducted in June 1995 at Pekalongan suggest that the price differences between the largest size and the smallest do not exceed 15% (Tab. 9). However, these findings need to be checked on a bigger scale.

**Table 9 : Relation between size and price of main pelagic species
(fresh fish of high quality; June 1995; 134 traders)
Hubungan antara ukuran dan harga jenis ikan pelagis utama
(ikan segar/kualitas terbaik; Juni 1995; 134 penjual)**

Pekalongan	<10 cm	10-15 cm	15-20 cm	>20 cm	Average
<i>Decapterus spp.</i>	630	650	670	690	680
<i>Rastrelliger kanagurta</i>	970	990	1,130	1,160	1,140
<i>Amblygaster sirm</i>	-	570	630	-	610
<i>Sardinella gibbosa</i>	-	380	440	-	400
<i>Selar crumenophthalmus</i>	540	550	580	630	590
<i>Euthynnus affinis</i>	1,160	1,210	1,350	1,440	1,360

Source : field survey (December 1994-February 1995)

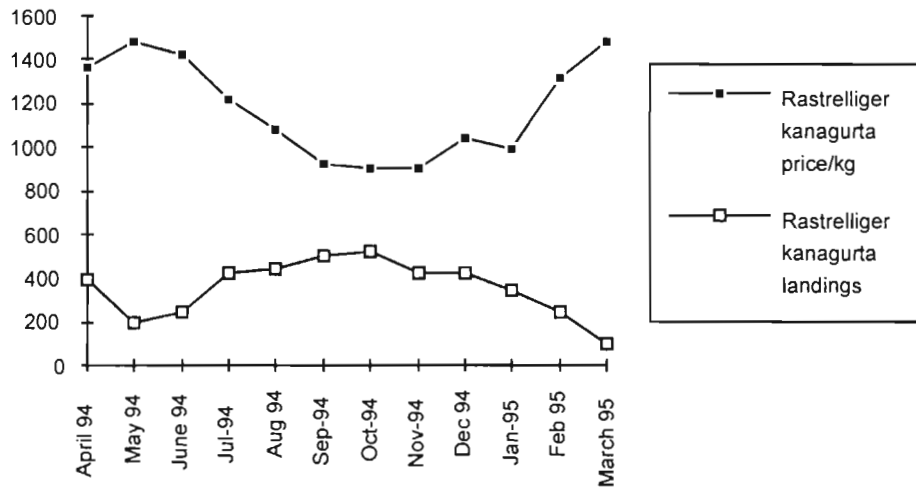
- Seasonal variations

Pelagic fishery activities are deeply influenced by the season depending on the monsoon. An analysis of the monthly landings of the last seven years (1987-1994) led us to characterise seasons as follows : low season lasts from March to July inclusive, while high season is from August to February.

If we consider the three harbours together, there is clear imbalance in the landings according to the auction place and the species. Imbalance between species : last year's 90,000 tons of *Decapterus* represented 50% of total landings. Imbalance between auction places : in 1994, Pekalongan had over half of all landings, while Tegal *kotamadya* posted only 10% (20,000 tons) and Juwana just a third (50,000 tons).

The comparison of the prices and seasonal supply brings out a clear relationship for every species. This relationship is shown in a striking inversion between the landing curves and price curves (Fig. 1, 2 and 3). We could interpret it as the first indicator of fluidity in supply and demand.

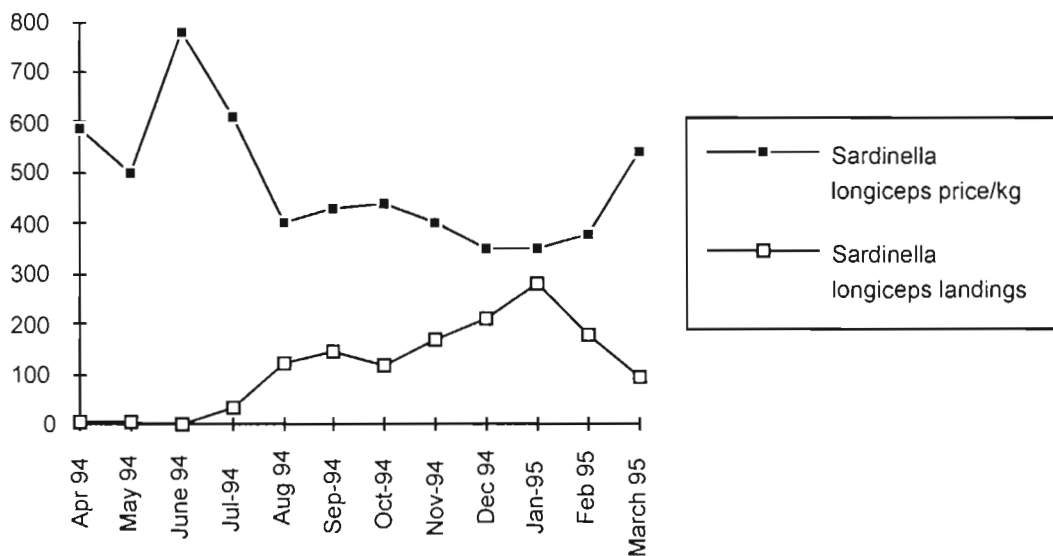
Rastrelliger kanagurta prices and landings at Juwana (April 94-March 95; in rupiah and tons)



Source : TPI

**Figure 1 : *Rastrelliger kanagurta* prices and landings at Juwana, (rupiahs and tons)
Harga dan jumlah ikan *Rastrelliger kanagurta* di Juwana;(rupiah dan ton)**

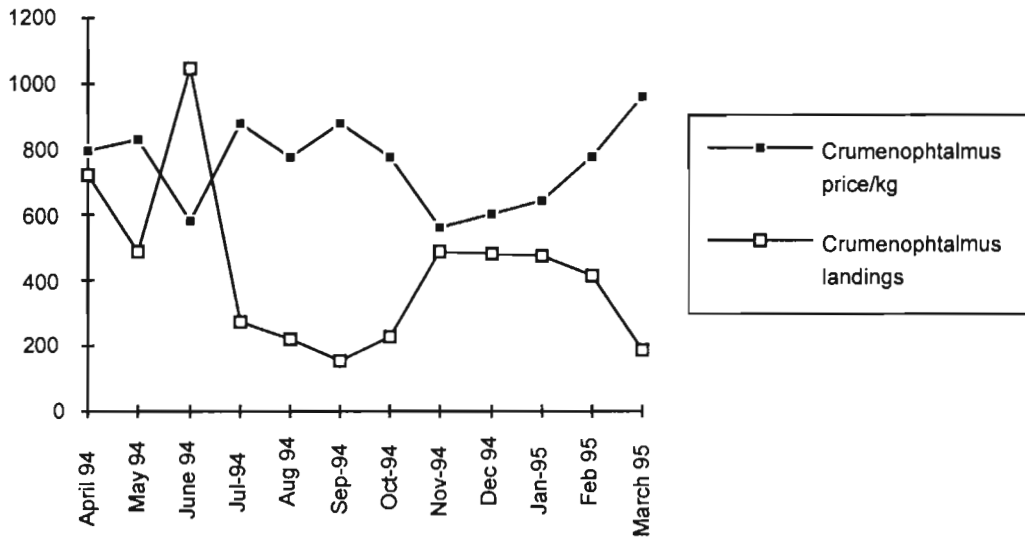
Amblygaster sirm prices and landings at Tegal (April 94-March 95; in rupiah and tons)



Source : TPI

**Figure 2 : *Amblygaster sirm* prices and landings at Tegal, (rupiahs and tons)
Harga dan jumlah ikan *Amblygaster sirm* di Tegal, (rupiah dan ton)**

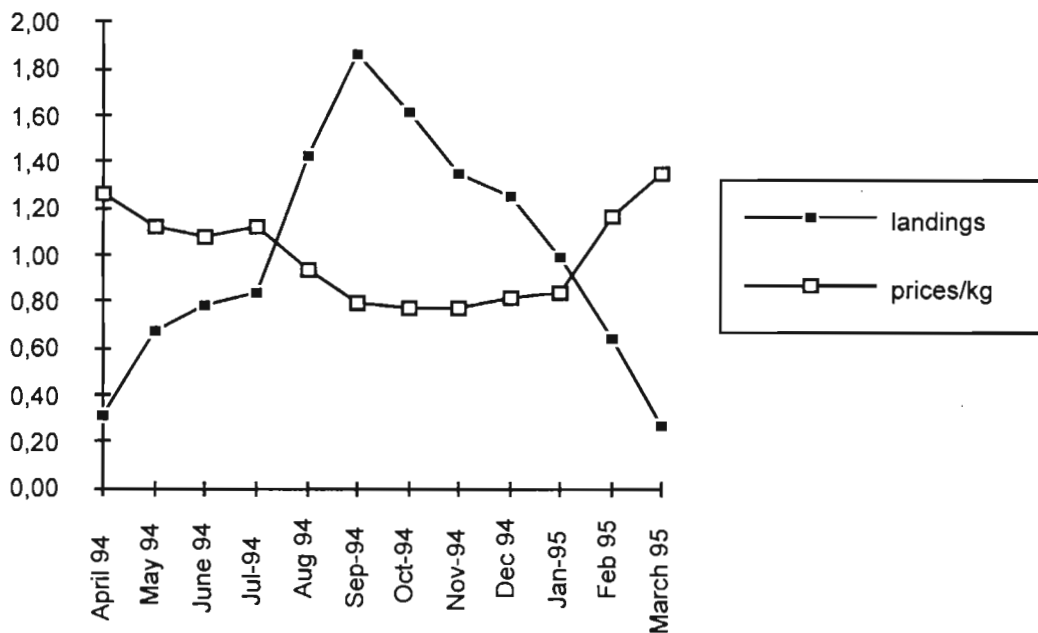
**Crumenophtalmus prices and landings at Pekalongan
(April 94-March 95; in rupiah and tons)**



Source : PPN

**Figure 3 : Selar crumenophtalmus prices and landings at Pekalongan (rupiahs and tons)
*Harga dan jumlah ikan Selar crumenophtalmus di Pekalongan (rupiah dan ton)***

By analysing the three auction places as a whole, a significant inversion relationship appears between *Decapterus* landings and prices (Fig. 4). Such a relationship leads to the hypothesis of market integration : trader behaviour is defined by the overall state of landings at all the auctions. The traders anticipate the demand further down the marketing and processing chain.



Source : field survey (December 94-February 1995; 842 transactions)

**Figure 4 : Deviation from the average of *Decapterus* prices and landings in relation to the monthly average (Tegal kotamadya, Pekalongan, Juwana; in rupiahs and tons)
*Rata-rata standar deviasi dari harga dan jumlah ikan dari ikan *Decapterus* kaitannya dengan rata-rata per bulan (Tegal kotamadya, Pekalongan, Juwana)***

- Adjustment of supply and demand on the fish auctions

The influence of supply on the price is brought out by determining the ratio between the quantity supplied and the price per kilo. Of course, prices fall when landings rise. Seasonal variations have already highlighted the inversion relationship between variations in landings and variations in prices.

The adjustment in the prices compared to the quantities could be analysed as signalling the satisfactory functioning of the auctions. It is confirmed by the data, even though the price/quantity elasticity is not so high in the daily data because daily averages are subject to greater variation than monthly averages. For example at Pekalongan, a 20% increase over the average landings of *Decapterus* was reflected in a 7% fall below average prices. A 20% increase over the average landings at Juwana led to a 4% fall below average prices.

However, the elasticity of prices for all species on one auction compared to the landings of all the auctions is higher than the elasticity of prices on one auction place compared to its own landings. It could be understood as an anticipation of the demand further down the production and marketing chain.

The prominent role of Pekalongan in the price setting at the other auction places ties in its volume of landings (more than 50% of the landings of all three auction places in 1994). Indeed, for most species, the elasticity of the prices of one place compared to the landings of all three turn on the price/quantity elasticity at Pekalongan.

- Substitutability among the species

In what measure will the trader report purchases of a substitute species if his favoured species is too expensive (due, for instance, to circumstantial scarcity)? We began with an empirical pinpointing of species of roughly the same price level. Through breakdown analysis of the Pekalongan prices, we ended up grouping together two low-priced species (*S. gibbosa* and *A. sirm*) and two species with a higher price (*R. kanagurta* and *S. crumenophthalmus*).

Showing inter-species substitutability therefore needs the daily comparison of the prices of similar species. To study it, we used again the calculation of price/quantity elasticity. The elasticity of prices for *R. kanagurta* and *S. crumenophthalmus*, compared to the prices of *A. sirm* and *S. gibbosa* showed a very strong substitutability in both cases. For low as for high priced species, the elasticity coefficients were 0,9 and 0,8 respectively. The substitutability analysis might be improved if categories of size are accounted for, because inter-species substitution can occur according to size classes rather than species. Its improvement might induce a test of the elasticity of the small pelagic compared to *Decapterus*. In diminishing the tension caused by the temporary scarcity of certain species, such substitutability confirms the fluidity of supply and demand as already seen about the adjustment of prices and quantities.

Price structure

The price at which the auction traders sell the fish includes marketing and processing costs and a margin. The 359 interviews of all the traders and the three-month daily follow-up of a sample of thirty operators (1,747 questionnaires) allowed us to quantify the costs and margins.

- Marketing costs

These costs differ depending on whether they integrate processing or not. Every type has its specific costs according to the expense of the handling, stocking, packaging, transport and taxes. The marketing costs are obviously higher when the product is processed or chilled. Processing (fuel, labour) and packaging (ice, salt) respectively represents roughly half and a quarter of the costs.

The processing entails high handling costs, which puts a strain on the overall cost of the product. However, these costs are not homogeneous since it costs almost twice as much to process boiled or smoked fish as dried-salted fish. Two other factors also work to increase costs. At first, by stockpiling practices, traders try to protect themselves against fluctuations in price or supply (mainly in low season). Second, mainly in the case of chilled or boiled fish, the packaging is costly. Processing and packaging entail high transportation costs because the favoured marketing sites are remote from the auction places.

- Commercial margins

Classification of the various operators confirms the existence of two types of traders depending on whether the fish is processed or conditioned. So quantities obviously affect the margin, accentuated by the economies of scale when there is processing or packaging. This accentuation is highlighted by the relationship between the net margins per kilo and the quantities traded. For chilled or processed fish, the paying off the fixed costs is lighter when the volumes increase. When this intermediate stage does not exist, the economies of scale are not significant.

Classification of the traders according to the level of the margin shows very differing results depending on the specialisation. Small scale operators (daily margin under Rp. 10,000) represent half of the traders of smoked fish. They are absent of the trade or processing of dried-salted fish with its very high proportion of large scale operators (daily margin over Rp. 50,000). These observations corroborate the relationship between margins and quantities traded : the small scale operators are edged out of the packaging and processing activities.

3. The marketing channels

The study concerned only the first step of the chain, that are the auction places. This option led to an overestimation of the quantities marketed in Central Java. A large share (in particular fresh and salted fish) will be locally processed into dried-salted or boiled fish and then exported out of the province.

Concerning the fish auctions studied, the following observations can be made. First, there is to be considered the vitality of the long distance channels to other provinces and even abroad. Furthermore, it exists a relative specialisation of each auction, with a very leading position of Pekalongan, as for the landings as for the processing capacities. It accounts for its greater share of the export market than the other auctions (60% during the high season).

However, one must remember the above-mentioned probable underestimation of the exports from Central Java. Cargoes exported from Juwana to West Java represent a particular case, because a significant amount is simply passing through Pekalongan before being forwarded to West Java. Such a phenomenon confirms the attraction force of Pekalongan.

The location-specific specialisation testifies to a commercial tradition. The operators of Tegal have developed dried-salted fish marketing channels toward West Java and Sumatra, but they are not significantly present on the export markets or those supplying East Java. At the opposite, the traders of Juwana have succeeded in developing marketing channels to West Java and even East Java, that absorb almost a quarter of its production during the high season. While Tegal and Pekalongan are oriented to West Java (respectively 42 and 55% of the selling), Juwana is oriented to East Java.

The impressive development of the chilled fish marketing channels takes in all three auction places. This vitality is particularly evident in Pekalongan (11,000 tons dispatched, 7,400 tons of which to West Java during the high season). West Java is also the favoured destination of the chilled fish dispatched from Juwana or Tegal. The Juwana traders of Juwana have opened up to the East (5,600 tons of boiled fish and 1,350 tons of salted fish during the high season).

However, if we look at the destinations, we observe that, for every type of processing, the biggest traders are the ones sending the fish out of Central Java. The small operators do not reach the more remote markets, because of the relatively heavy costs involved. They would have to struggle to satisfy these markets with regular supply and quality. These observations tie in with the ones made about the concentration of processors and the oligopolistic temptations that some of them may have.

CONCLUSION

Although the fish market has benefited from constant demand, the fluidity and transparency of the transactions are a credit to the auction sites.

Business strategies, drawn up by the whole operators anticipating a global demand, provide indications of auctions' interconnection and lack of segmentation, as already noted by some authors (Bailey *et al.*, 1987). Catch information can help in the choice of landing port and purchase price levels. Such information may even lead ship owners to eventually support the prices (Potier, personal communication.)

The price elasticity of *Decapterus* (the main species) on one fish auction, compared to the whole landings at all the auctions, shows how integrated the market is. This integration is enhanced by the great substitutability among species that can ease tensions due to the temporary scarcity of a particular species and increase the fluidity of supply and demand.

New marketing methods provide a satisfactory means of channelling fish onto both neighbouring and more remote markets. The pelagic fishes passing through auctions of Tegal, Pekalongan and Juwana are distributed throughout the island of Java and beyond.

We have observed how difficult small scale operators can reach remote markets. Downstream contractors seek secure supplies, guaranteed quality and competitive prices, even if it contributes to pools of working capital and investment. Dictated by the downstream links of the marketing chain, these constraints explain a high concentration of processors (of mainly dried-salted and boiled fish). The biggest of them can capitalise on the processing level economies of scale and have a comparative advantage over the small scale traders. Such a concentration of operators could open the way to oligopolistic deals reinforced by strategic ties held by the downstream wholesalers. Improved structuring of the little traders would create healthy sales conditions within the marketing chain.

The analysis of price formation shows a significant adjustment of prices with the quantities. It also brings out the dominant role played by some operators (Pekalongan), that could entail the secondary auctions to become satellites to the bigger ones, as already observed by Nikijuluw (1994). The process could be halted by modernising the oldest auction places (such as Tegal), by improving port infrastructures and expanding storage and packaging facilities.

The explanatory variables explaining prices raise the freshness of the fish to the level of a determining variable. The difference in price between high and low quality is very great, considering for example that the ratio for *Decapterus* was as high as 2.5. Overall, a major depreciation in the value of landings draws attention to the benefits of better preservation on board and during landing.

This study shows two avenues of research on marketing and processing of pelagic fish. The first concerns the commercial strategies all the way down the chain. The second would consist in building a model of explanatory variables for price levels.

The first programme should focus on pinpointing the linkages between the various segments of the processing and marketing chain (from the fish auctions to the retail markets). A preliminary step could be to describe the relationships between the actors able to artificially manipulate supply and demand.

The second programme would build a model of the explanatory variables of price levels. It would link the price of a given product to its qualitative and quantitative components, such as those concerning the social or spatial organisation of the marketing channels. Multiple classification, or multiple regression using categorical predictors, is the appropriate technique for building such a model. It allows the study of relationships between several explanatory variables and the organisation into a hierarchy of the percentage of the total value explained by each predictor (Andrews *et al.*, 1973).

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